HYDRA®
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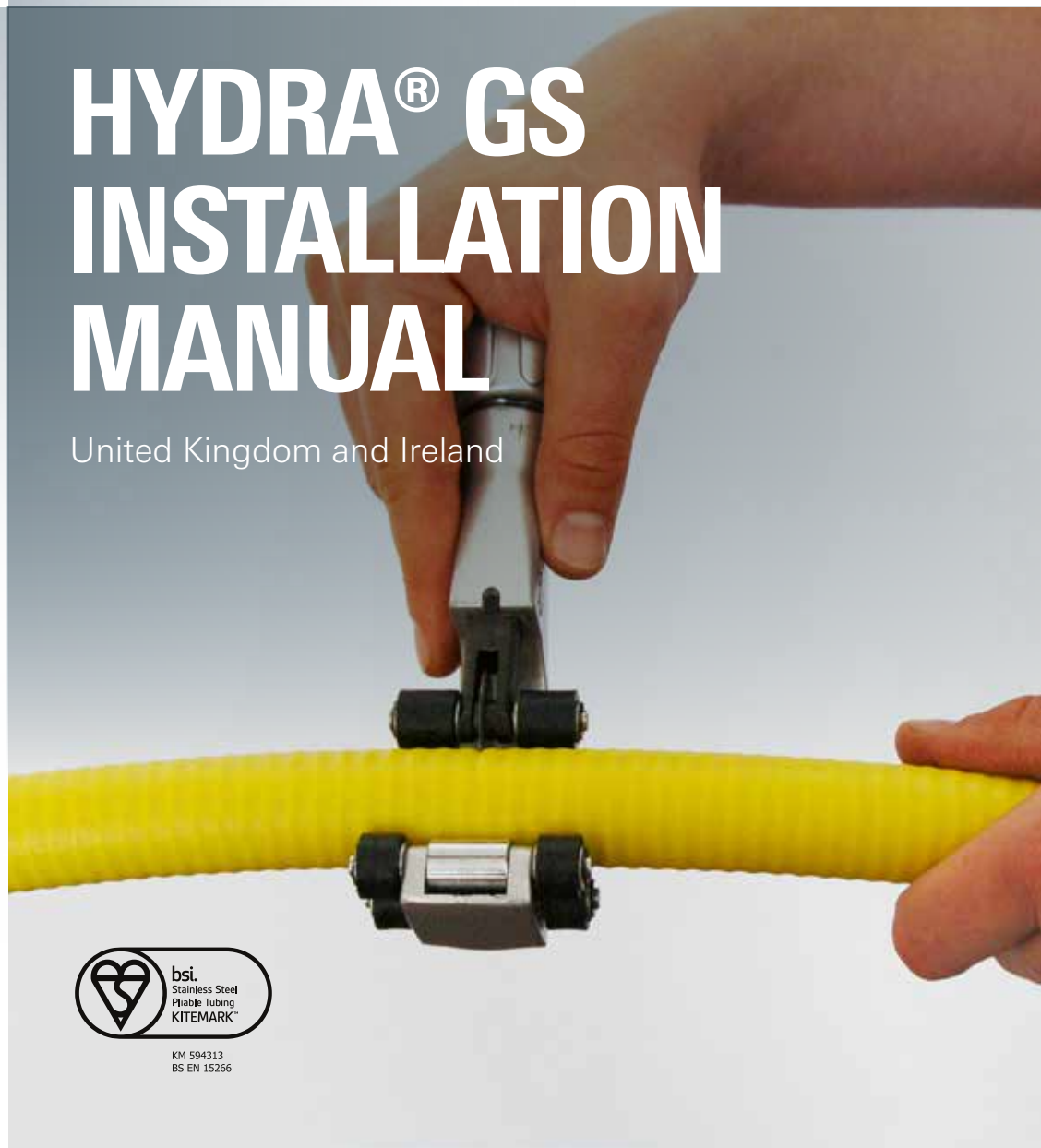
HYDRA® GS INSTALLATION MANUAL

United Kingdom and Ireland



bsi.
Stainless Steel
Pliable Tubing
KITEMARK™

KM 594313
BS EN 15266

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1. SCOPE OF APPLICATION AND GENERAL NOTES

1.1. Validity

This installation instruction is valid for the gas installation system HYDRA GS made by Witzenmann GmbH, Germany. It is intended to guide the gas pipe installer in the design, installation and final testing stages. All specifications in this manual must be complied with during work and installation. No deviations from the installation specifications in this manual are permitted without prior consultation with Witzenmann GmbH.

1.2. The product

The Witzenmann gas installation system HYDRA GS complies to and is tested according to the requirements of BS EN 15266:2007 (Stainless steel pliable corrugated tubing kits in buildings for gas with an operating pressure up to 0.5 bar). The gas installation system HYDRA GS has been granted Kitemark Licence Number KM 594313 by British Standards Institution, covering sizes DN 15, DN 22, DN 28 and DN 32 and associated fittings. The certification also includes resistance to high temperatures (HTB) according to BS EN 1775. HYDRA GS can be installed in domestic, industrial and commercial buildings. HYDRA GS is suitable for natural gas and liquified petrol gas (2nd and 3rd family gas).

1.3. Definition

1.3.1. System definition
HYDRA GS is a flexible gas installation system for carrying gas in the building technology. HYDRA GS is offered in the four nominal diameters DN 15, DN 22, DN 28 and DN 32. HYDRA GS consists of flexible corrugated hoses and HYDRA GS Press fittings or HYDRA GS Click fittings, special fastening elements, a battery-operated axial pressing tool for expanding the HYDRA GS Press fittings and configuration software for determining the size of the pipelines.

1.3.2. Flexible corrugated hoses PLT (pliable tube)
Corrugated, sheathed pipe which can be bent by hand easily for a limited number of times.

1.4. Specifications

Gas installers shall be in possession of a valid certificate of competence for activities necessary to install and test the gas installation system HYDRA GS, see BS 6891 section 4. The valid certificate must have been issued under either the Approved Code of Practise (ACoP) or the National Accredited Certification Scheme (ACS) for individual gas installers or an equivalent qualification.

All businesses and individuals undertaking gas work on installations supplied with natural gas or LPG must be registered with a body approved by the Health and Safety Executive (HSE). (In Great Britain it is The Gas Safe Register. In Northern Ireland, the Cannel Islands and the Isle of Man, consult the relevant authorities for up-to-date guidance.) All gas appliances and other gas fittings must be installed in accordance with The Gas Safety (Installation and Use) Regulations 1998, building regulations and manufacturers' installation instructions. Installations should also comply with British Standards. (Our Design and Installation Guide revisions will follow any amendments to the Regulations or British Standards at a later date, and thus in the event of any conflict the Regulations and/or British Standards will take precedence over this Design and Installation Guide).

For detailed information about connection / disconnection of pipes, installation in different materials (e.g. wooden joist floors; walls; cavities walls; etc.) see BS 5482-1 sections 12.3 ff and BS 6891 section 8.6 ff. Note: these standards are currently under revision with the aim to condense the design and installation specifications for all domestic fuel gas pipework systems into one standard. Installation for industrial and commercial premises shall follow IGEM/UP/2 Latest Edition (for sizes above DN 32 and working pressure above 21 mbar) and IGE/UP/1 Latest Edition (strength and tightness testing and purging). Additional local regulations shall also be followed. Please contact local authorities for necessary information.

This installation guide cannot cover all possible variations in construction style, building configuration, appliance requirements or local restrictions. If the installer is unsure about the proper application of HYDRA GS, we recommend you contact us or a local representative.

1.5. Standards and codes of practice

As well as the planning and installation instructions given in this installation manual, it is also necessary to comply with the current editions of the following codes of practice when planning and installing the entire gas supply system in the building:

BS EN 15266:2007	Stainless steel pliable corrugated tubing kits in buildings for gas with an operating pressure up to 0.5 bar
BS EN 549	Rubber materials for seals and diaphragms for gas appliances and gas equipment
BS EN 10226-1:2004-09	Pipe threads where pressure tight joints are made on the threads – Part 1: Taper external threads and parallel internal threads – Dimensions, tolerances and designation
BS EN 14291:2005-4	Foam producing solutions for leak detection on gas installations
BS EN 837-1:1997-02	Pressure gauges – Part 1: Bourdon tube pressure gauges; Dimensions, metrology, requirements and testing
BS EN 681-1: 2003-8	Elastomeric seals – Material requirements for pipe joint seals used in water and drainage applications – Part 1: Vulcanized rubber
BS 6891	Installation of low pressure gas pipework of up to 35 mm (R1 1/4) in domestic premises (2nd family gas) - Specification
BS 5482-1	Code of practice for domestic butane- and propane-gas-burning installations. Part 1: Installations at permanent dwellings, residential park homes and commercial premises, with installation pipework sizes not exceeding DN 25 for steel and DN 28 for corrugated stainless steel or copper
IGE/UP/1 (Edition 2)	Strength testing, tightness testing and direct purging of industrial and commercial gas installations.
IGEM/UP/2 (Edition 3)	Installation pipework on industrial and commercial premises.
BS EN 437	Test gases – Test pressures – Appliance categories

Important Note:
Cross references to regulations, standards and codes of practice refer to the current status at the time when this installation manual was published. In the event of updates, the user is responsible for applying the current regulations, standards and codes of practice applicable at the given time. The generally accepted engineering standards must always be complied with.

1.6. System conformity

Only components from the HYDRA GS system may be used for installation.
The HYDRA GS installation system made from Witzenmann corrugated pipes is not compatible with the corrugated pipe kits for gas installations from other manufacturers.
Witzenmann GmbH does not accept any liability for malfunctions that are caused by mixing with system components from other manufacturers. For installation of all gas appliances and other gas fittings, it is necessary to comply with the installation instructions of the manufacturer, the applicable safety guidelines as well as the corresponding building regulations and standards.

1.7. Areas of application

The HYDRA GS made from flexible stainless steel corrugated pipes can be used for
- New installations of pipeline systems
- Renewing existing pipeline systems
- Extending existing pipeline systems

1.8. Operating conditions

- Max. operating pressure 500 mbar
- Temperature range -40 °C to +60 °C
- Natural gas / liquefied gas

2. HYDRA® GS INSTALLATION SYSTEM AND THE SYSTEM COMPONENTS

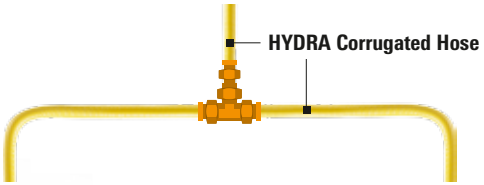
The HYDRA GS system offers the installer easy and safe installation of gas pipelines. The flexible gas pipe is easy to transport and lay; the connecting technology is simple and unproblematic, both in design and in handling.

The system is available in 2 designs:
As a Click System for easy assembly with no hydraulic tool. For this system, the fittings are connected using a simple plug connection. The fitting is self-locking and only needs to be screwed tight using a spanner or wrench afterwards. Information on all components can be found in chapter 2.1.

As an alternative, there is the Press System with a hydraulic tool for quick and effective assembly over long distances. For this system, the fittings are connected using a special hydraulic tool. It is light, easy to use and is ergonomically shaped. This makes it possible to work longer without tiring. Information on all components can be found in chapter 2.2.

Country-specific approvals ensure that HYDRA GS systems fulfil all requirements for a long and safe service.

HYDRA® GS



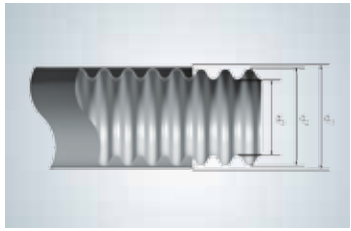
HYDRA® GS CLICK

The manual "Quick System"

HYDRA® GS PRESS

The system using a hydraulic tool

HYDRA® GS corrugated pipes and pipe dimensions

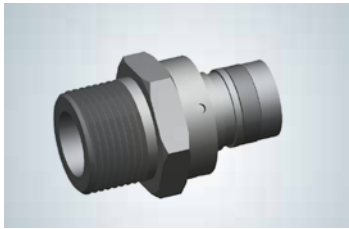


Stainless steel corrugated pipe for gas installation
- Pipe material: 1.4404 (stainless steel)
- Sheathing material: PE (polyethylene)

DN	Pipe dimensions			Corrugated pipe length
	d1 + PE	d2	d3	on drum
	mm	mm	mm	m
15	22.1	21.2	16.5	15 / 30 / 75
22	27.3	26.4	20.5	15 / 30 / 75
28	32.6	31.7	25.7	15 / 30 / 75
32	41.5	40.6	35.5	15 / 30 / 75

2.1. HYDRA® GS Press

Threaded nipple – HYDRA® GS Press

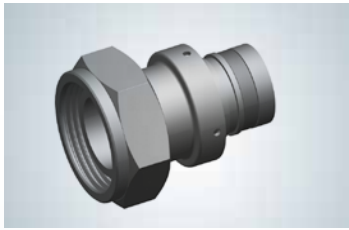


Threaded nipples with male thread acc. to DIN EN 10226-1 are used for connecting the pliable HYDRA GS stainless steel corrugated pipes to the female thread connections of valves, fittings or gas sockets.

- Material: brass
- Seal ring: HNBR

Dimensions [Nominal diameter x thread acc. to EN 10226-1] DN	Article number	Weight kg
15 x R ½	1198211	0.064
22 x R ¾	1198212	0.120
28 x R 1	1198213	0.175
32 x R 1 ¼	1198214	0.248

Swivel connection – HYDRA® GS Press

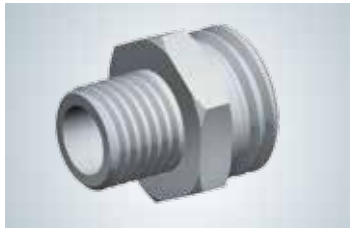


The rotating connection has a 24° cone and is used for connecting the pliable HYDRA GS stainless steel corrugated pipes to valves or fittings with an male thread and a 24° cone.

- Material: brass
- Seal ring: HNBR
- O-ring: HNBR

Dimensions [Nominal diameter x cone x union nut thread] DN	Article number	Weight kg
15 x 24° x M30 x 2	1198215	0.112
22 x 24° x M30 x 2	1198216	0.131
28 x 24° x M36 x 2	1198217	0.178
32 x 24° x M48 x 2	1198221	0.333

Adapter – HYDRA® GS Press

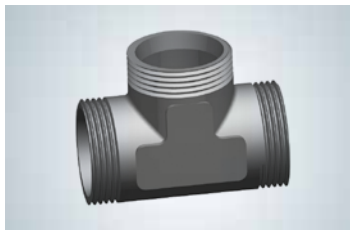


The adapters have a pipe thread acc. to DIN EN 10226-1 and a 24° cone with male thread. Together with the rotating connection, they form a conically sealing threaded connection with a swivel connection for connecting the pliable HYDRA GS stainless steel corrugated pipes to the female threaded connections of valves, fittings or gas sockets.

- Material: brass

Connection to fitting [Nominal diameter x thread acc. to EN 10226-1] DN	Connection to nipple with union nut [Nominal diameter x cone x thread] DN	Article number	Weight kg
15 x R ½	15 x 24° x M30 x 2	1198227	0.077
22 x R ¾	22 x 24° x M30 x 2	1198228	0.095
28 x R 1	28 x 24° x M36 x 2	1198229	0.166
32 x R 1 ¼	32 x 24° x M48 x 2	1198230	0.254

T-piece – HYDRA® GS Press

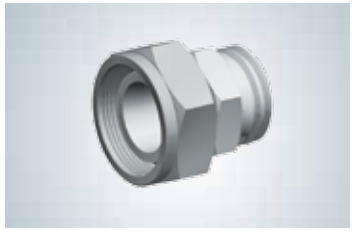


The T-pieces have a 24° cone with male thread at each end. They are used as connection elements to other lines and thus make it possible to connect additional consumers.

- Material: brass

Dimensions [Nominal diameter x thread] DN	Article number	Weight kg
15/22 x M30 x 2	1198222	0.196
28 x M36 x 2	1198224	0.258
32 x M48 x 2	1198226	0.552

Reducer – HYDRA® GS Press

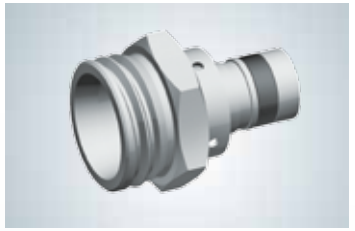


Reducers have a large 24° cone with a rotatable union nut and a smaller 24° cone with male thread. They are used for reducing the diameter of branches to the existing connection. This means it is possible to make connections to additional lines using smaller nominal diameters. The reduction from DN 20 to DN 16 is made directly with the rotatable connections, since these are compatible in diameter and thread.

- Material: brass
- O-ring: HNBR

Connection to hose [Nominal diameter x thread] DN	Connection to T-piece [Nominal diameter x cone x union nut thread] DN	Article number	Weight kg
22 x M30 x 2	25 x 24° x M36 x 2	1198231	0.190
28 x M36 x 2	32 x 24° x M48 x 2	1198232	0.397

Conical nipple – HYDRA® GS Press



The cone nipples have a 24° cone with male thread and are connected using a swivel connection in order to connect two HYDRA GS stainless steel corrugated pipes of the same diameter together.

- Material: brass
- Seal ring: HNBR

Dimensions [Nominal diameter x cone x thread] DN	Article number	Weight kg
15 x 24° x M30 x 2	1198233	0.083
22 x 24° x M30 x 2	1198234	0.096
28 x 24° x M36 x 2	1198235	0.130
32 x 24° x M48 x 2	1198236	0.233

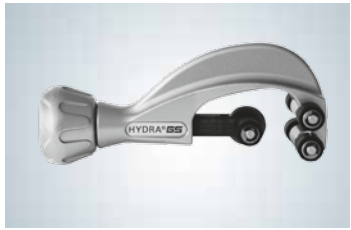
Press case – HYDRA® GS Press

Tool case

Case content

1 Charger
2 Expansion head
3 Axial pressing tool
4 Adhesive tape
5 4 Press heads: DN 15 / DN 22 / DN 28 / DN 32
6 Pipe cutter

Pipe cutter – HYDRA® GS Press

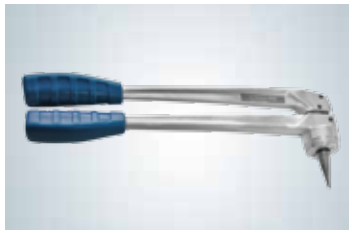


The corrugated pipe cutter is used for cutting the corrugated tube to the required length.

Dimensions [Nominal diameter] DN	Article number
15 to 32	1158149

Expansion head – HYDRA® GS Press

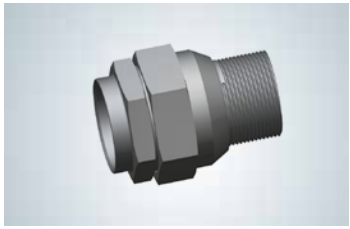
The expansion tool is used for correcting the deformation of the cut edge created when cutting the corrugated pipe and for expanding the corrugated pipe to the diameter required for assembly with the fitting. The expander head is compatible with commercially available expansion tongs or electrohydraulic guns with 18° cones.



	Dimensions [Nominal diameter] DN	Article number
Expansion head	15 to 32	1060722
Expansion tool	15 to 32	1078856

2.2. HYDRA® GS Click

Threaded BSP fixed taper male – HYDRA® GS Click

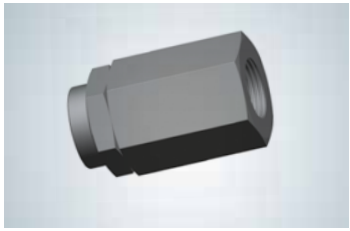


Threaded BSP fixed taper male acc. to DIN EN 10226-1 are used for connecting the pliable HYDRA GS stainless steel corrugated pipes to the female thread connections of valves, fittings or gas sockets.

- Material: brass
- Seal ring: HNBR

Dimensions [Nominal diameter x thread acc. to EN 10226-1] DN	Article number	Weight kg
15 3/8	1197725	0.181
15 1/2	1197726	0.191
22 3/4	1197727	0.322
28 1	1197728	0.331
32 1¼	1197729	0.440

Threaded BSP para fixed female – HYDRA® GS Click

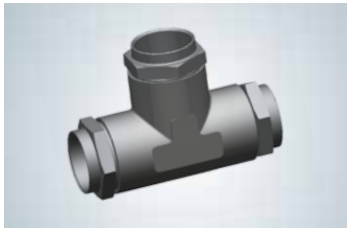


Threaded BSP para fixed female acc. to DIN EN 10226-1 are used for connecting the pliable HYDRA GS stainless steel corrugated pipes to the male thread connections of valves, fittings or gas sockets.

- Material: brass
- Seal ring: HNBR

Dimensions [Nominal diameter x thread acc. to EN 10226-1] DN	Article number	Weight kg
15 1/2	1197731	0.20
22 1/2	1197732	0.33
28 1/2	1197733	0.316
22 3/4	1197734	0.302
28 3/4	1197735	0.286
32 3/4	1197736	0.420

T-piece – HYDRA® GS Click



The T-pieces are used as connection elements to other lines and thus make it possible to connect additional consumers.

- Material: brass
- Seal ring: HNBR

Dimensions [Nominal diameter x thread acc. to EN 10226-1] DN	Article number	Weight kg
15	1197740	0.517
22	1197739	0.918
28	1197742	0.849
32	1197748	1.54
22 x 22 x 15	1197738	0.863
22 x 15 x 15	1197741	0.783
28 x 28 x 15	1197744	0.798
28 x 22 x 22	1197746	0.865
28 x 22 x 15	1197747	0.813
32 x 28 x 22	1197749	1.446
32 x 28 x 15	1197751	1.342

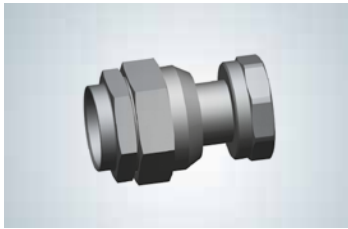
Solder socket – HYDRA® GS Click

Connection part with solder lugs for connecting pliable HYDRA GS stainless steel corrugated pipes with copper lines.

- Material: brass
- Seal ring: HNBR

Dimensions [Nominal diameter x thread acc. to EN 10226-1] DN	Article number	Weight kg
DN 15 Ø 15	1197771	0.267
DN 22 Ø 15	1197772	0.282
DN 22 Ø 22	1197766	0.287
DN 28 Ø 22	1197767	0.267
DN 28 Ø 28	1197768	0.268
DN 32 Ø 22	1197769	0.344
DN 32 Ø 28	1197770	0.349

Connection BS 746 female – HYDRA® GS Click



Connection part for connecting to gas meter with 1" thread acc. to BS 746

- Material: brass
- Seal ring: HNBR

Dimensions [Nominal diameter x thread acc. to EN 10226-1] DN	Article number	Weight kg
22	1197763	0.374
28	1197764	0.370
32	1197765	0.462

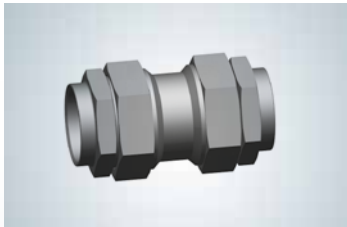
Copper compression fitting – HYDRA® GS Click

Compression fitting for connecting pliable HYDRA GS stainless steel corrugated pipe with copper lines.

- Material: brass
- Seal ring: HNBR

Dimensions [Nominal diameter x thread acc. to EN 10226-1] DN	Article number	Weight
		kg
DN 15 Ø 15	1197756	0.203
DN 22 Ø 15	1197757	0.316
DN 22 Ø 22	1197758	0.342
DN 28 Ø 22	1197759	0.313
DN 28 Ø 28	1197761	0.335
DN 32 Ø 22	1197760	0.416
DN 32 Ø 35	1197762	0.462

Straight Coupling – HYDRA® GS Click



Connection part to connect two HYDRA GS stainless steel corrugated pipe of same diameter.

- Material: brass
- Seal ring: HNBR

Dimensions [Nominal diameter x thread acc. to EN 10226-1] DN	Article number	Weight
		kg
15	1197752	0.307
22	1197753	0.517
28	1197754	0.449
32	1197755	0.581

2.3. HYDRA® GS Press und HYDRA® GS Click

BISMAT®-Flash pipe clamp – HYDRA® GS

The BISMAT®-Flash pipe clamp is used for fastening the corrugated pipes to building structures or supporting structures.

- Material: galvanised steel
- Seal ring: EPDM (black)

DN	D	D	G	B	H	h	b x s	Article number
	mm	Inch		mm	mm	mm	mm	
15	20 - 23	½"	M8	54	39	23	r20 x 1.25	1052549
22	25 - 28	¾"	M8	59	44	26	r20 x 1.25	1052556
28	32 - 35	1"	M8	65	51	30	r20 x 1.25	1052560
32	40 - 43	1¼"	M8	74	60	34	r20 x 1.25	1052562

Caddy clip – HYDRA® GS

The holding loop is an alternative to the BISMAT-Flash pipe clamp and is also used for fastening the corrugated pipes to the building structure or supporting structures.

- Material: galvanised steel

DN	d	d	B	A	Article number
	mm	Inch	mm	mm	
22	26.9	¾"	60.3	31.8	1052521
28	33.7	1"	68.3	36.5	1052527
32	42.2	1¼"	77.8	41.3	1052528

Strip earth band - HYDRA® GS

The strip earthing clip is used for potential equalisation for the building installation.

- Material: stainless steel (V2A)

Type	for corrugated pipe diameter DN	Article number
927 1	15 to 32	1051809

Coroplast adhesive tape – HYDRA® GS

Type	Length x width	Article number
PVC302	10 m x 25 mm	1147254

3. DIMENSIONING THE PIPELINE SYSTEM

3.1. Basis for dimensions

The design and installation of low-pressure gas pipework in domestic premises is specified in BS 6891 (2nd family gas) and BS 5482-1 (3rd family gases), whilst pipework with larger bore sizes and higher operating pressure is covered in IGEM/UP/2 Latest Edition. Strength testing, tightness testing and direct purging of installation pipework are covered in the IGE/UP/1 standards.

			Natural gas L	Natural gas H	Propane
Operating temperature	t	°C	15	15	25
Operating pressure, absolute	p	Pa	103300	103300	106300
Net calorific value	$H_{i,B}$	kWh/m³	8.6	10.6	26.8

Dimensioning with the software tool allows a free choice of entries.

3.2. Preliminary dimensioning using table

When using the table, the pressure losses of the components are read in relation to the load. The pressure loss of the entire pipeline system is calculated by adding up the pressure losses along the course of the pipeline.
As a rule, the tables apply to individual lines. When there are several consumers, calculate backwards from them. From the branch onwards, calculate by taking the total of the individual loadings, whereby it is also possible to take into account a simultaneity factor for reducing the overall load.
The pressure losses of the straight corrugated pipes are specified below per metre.
Bends and connection parts inherent in the system are taken into account as additional pipe length.

$p_R = R \cdot (l_R + l_z)$ l in m

For all other components (flow monitor, gas meter, appliance connection fitting, etc.), use the information from the manufacturers. (Δp_{GS}, Δp_{ZG}, Δp_{GA})
The height difference between the start of the pipeline at the gas pressure control installation and the installation connection is taken into account acc. to the following formula.

$\Delta p_H = (-4) \cdot H$ H in m

The pressure loss in the pipeline is:

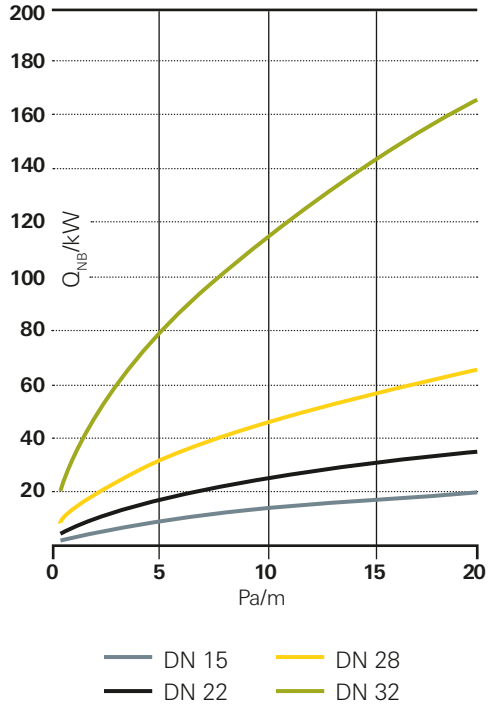
$\Delta p = \Delta p_R + \Delta p_{GS} + \Delta p_{ZG} + \Delta p_{GA} + \Delta p_H$

3.3. Pressure losses in the corrugated pipeline
depending on the nominal load

3.3.1. Natural gas L

Pressure loss in corrugated pipelines for natural gas L (15 °C, 20 mbar, 8.6 kW/m³)

R Pa/m		DN [mm] 15	22	28	32
0.4	Q_{NB} values in kW	2	4	8	20
0.6			5	10	25
0.8		3	6	11	29
1.0			7	13	33
1.2		4		14	36
1.4			8	16	39
1.6			9	17	42
1.8		5		18	45
2.0			10	19	48
2.5		6	12	21	54
3.0		7	13	24	60
3.5			14	26	65
4.0		8	15	28	70
5		9	17	31	79
6		10	19	34	87
7		11	20	37	95
8		12	22	40	102
9		13	23	43	108
10		14	24	45	115
12		15	27	50	127
14		16	29	54	138
16		17	31	58	148
20		20	35	66	167



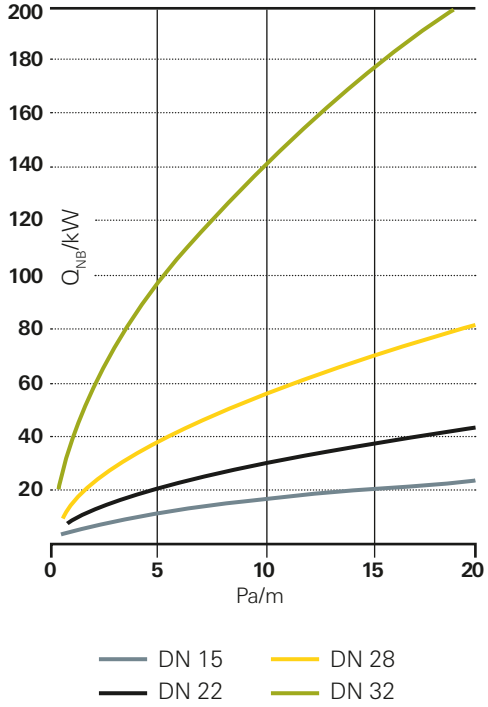
Pressure losses of the connection parts, additional lengths l_Z to the overall pipe length for system components

DN	Pressure losses in metres 90° bends	Hose connection	T straight	T branch
16	0.15	0.2	0.4	0.5
20	0.2	0.3	0.6	0.9
25	0.25	0.2	0.4	0.8
32	0.3	0.2	0.4	1.3

3.3.2. Natural gas H

Pressure loss in corrugated pipelines for natural gas H (15 °C, 20 mbar, 10.6 kW/m³)

R Pa/m		DN [mm] 15	22	28	32
0.4	Q_{NB} values in kW	3	5	10	24
0.6			6	12	30
0.8		4	8	14	36
1.0			9	16	40
1.2		5		18	44
1.4			10	19	48
1.6		6	11	21	52
1.8			12	22	55
2.0		7	13	23	59
2.5		8	14	26	66
3.0		9	16	29	73
3.5			17	32	80
4.0		10	18	34	86
5		12	21	38	97
6		13	23	42	107
7		14	25	46	116
8		15	27	49	125
9		16	28	53	133
10		17	30	56	141
12		18	33	61	156
14		20	36	67	169
16		21	39	72	182
20		24	43	81	205



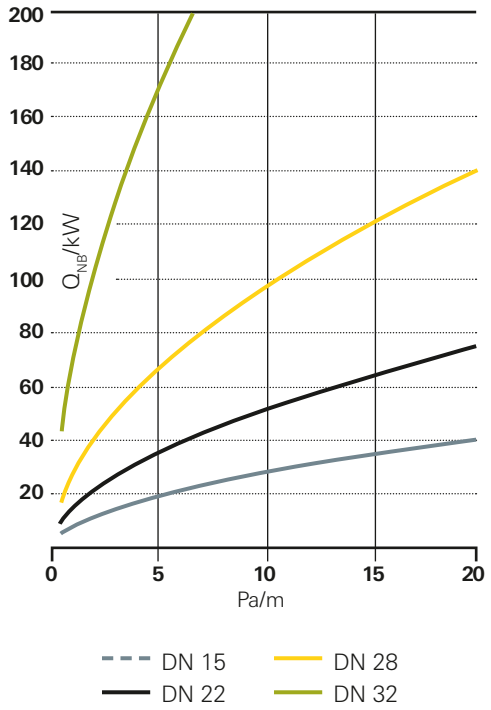
Pressure losses of the connection parts, additional lengths l_Z to the overall pipe length for system components

DN	Pressure losses in metres 90° bends	Hose connection	T straight	T branch
16	0.15	0.2	0.4	0.5
20	0.2	0.3	0.6	0.9
25	0.25	0.2	0.4	0.8
32	0.3	0.2	0.4	1.3

3.3.3. Propane gas

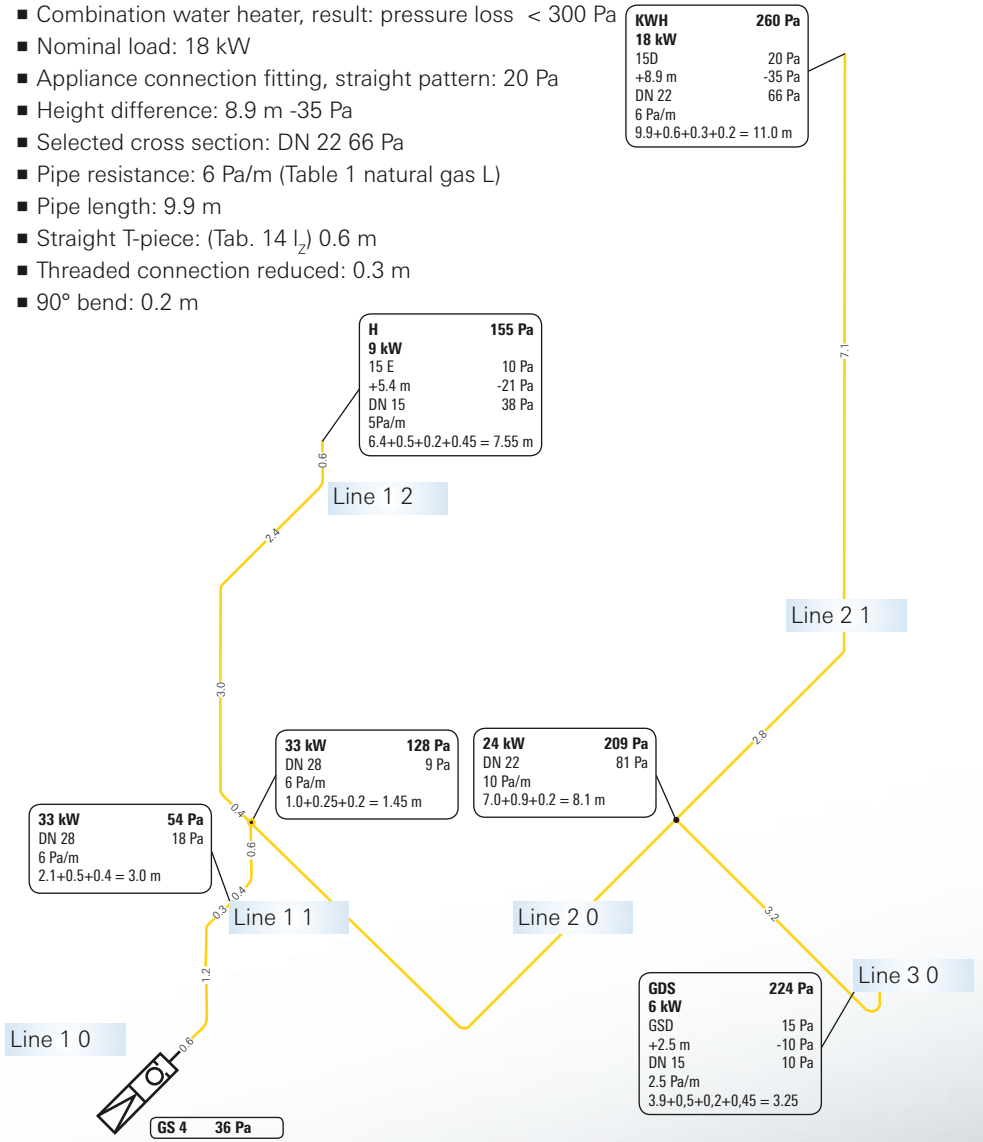
Pressure loss in corrugated pipelines for propane (25 °C, 50 mbar, 26.8 kW/m³)

R Pa/m		DN [mm] 15	22	28	32
0.4	Q_{NB} values in kW	5	9	17	43
0.6		6	12	21	54
0.8		7	13	25	63
1.0		8	15	28	71
1.2		9	17	31	79
1.4		10	18	34	85
1.6		11	20	36	92
1.8			21	39	98
2.0		12	22	41	104
2.5		14	25	46	117
3.0		15	27	51	129
3.5		16	30	55	141
4.0		18	32	60	151
5		20	36	67	171
6		22	40	74	188
7		24	43	80	205
8		25	46	86	220
9		27	49	92	235
10		29	52	97	249
12		31	57	107	274
14		34	62	116	298
16		36	67	125	321
20		41	75	141	362



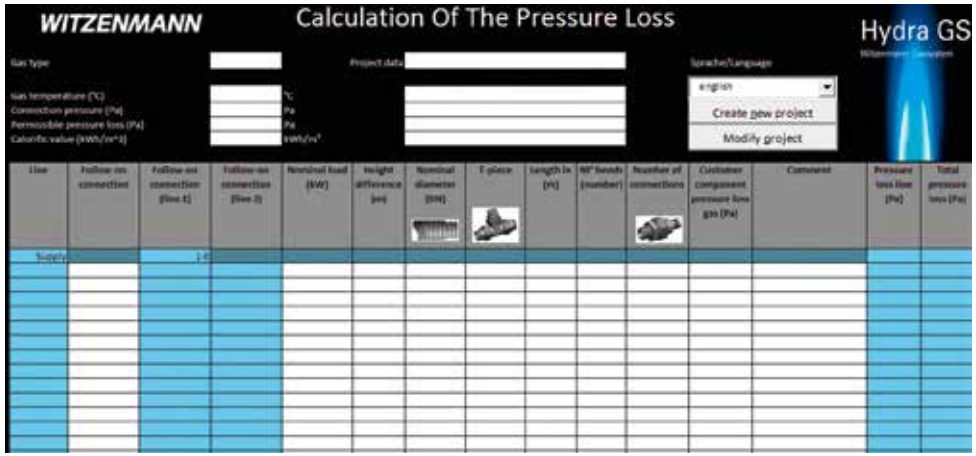
3.4. Example calculation

- Combination water heater, result: pressure loss < 300 Pa
- Nominal load: 18 kW
- Appliance connection fitting, straight pattern: 20 Pa
- Height difference: 8.9 m -35 Pa
- Selected cross section: DN 22 66 Pa
- Pipe resistance: 6 Pa/m (Table 1 natural gas L)
- Pipe length: 9.9 m
- Straight T-piece: (Tab. 14 l_z) 0.6 m
- Threaded connection reduced: 0.3 m
- 90° bend: 0.2 m



3.5. Pressure loss calculation with software tool

First, open the "HydraGS.xlt" file with a double-click.
Important: Macros must be activated.
To fill in the empty dialogue box, click one of the two buttons "Create new project" or "Edit project". A dialogue box appears which has the same structure. If a dialogue box is called up which has already been filled in (*.xls) then the "Create new project" button deletes all previous entries.



Selection of the gas type using the drop-down menu and the operating conditions in the head of the table. The proposed values for gas temperature, connection pressure, permissible pressure loss and net calorific value can be overwritten.

Gas type	Natural gas H			
Gas temperature (°C)	Natural gas L Natural gas H Propane	°C	Project data	
Connection pressure (Pa)		Pa		
Permissible pressure loss (Pa)	300	Pa		
Calorific value (kWh/m^3)	10,6	kWh/m³		

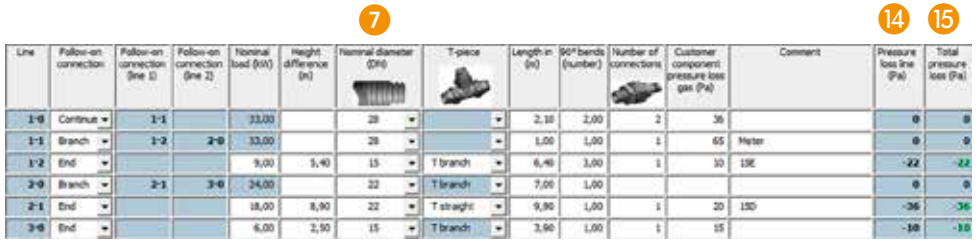
- Entry of the pipeline routing starting from the house connection in column 2. Select "Continue" if subdividing into several sections. Select "Branch" if a branch follows. If the line ends at the consumer, enter "End" and the nominal load (column 5). The lines are numbered automatically (columns 1, 3, 4). Entries are only possible in the white fields.

1	2	3	4	5	6
Calorific value (kWh/m^3)			10,6		kWh/m³
Line	Follow-on connection	Follow-on connection (line 1)	Follow-on connection (line 2)	Nominal load (kW)	Height difference (m)
1·0	Continue	1·1		33,00	
1·1	Branch	1·2	2·0	33,00	
1·2	End			9,00	5,40
2·0	Branch	2·1	3·0	24,00	
2·1	End			18,00	8,90
3·0	End			6,00	2,50

- In column 6, enter the difference in height between each consumer and the house connection.

7	8	9	10	11	12	13
Nominal diameter (DN)	T-piece	Length in (m)	90° bends (number)	Number of connections	Customer component pressure loss gas (Pa)	Comment
28		2,10	2,00	2	36	
28		1,00	1,00	1	65	Meter
15	T branch	6,40	3,00	1	10	15E
22	T branch	7,00	1,00			
22	T straight	9,90	1,00	1	20	15D
15	T branch	3,90	1,00	1	15	

- Enter the nominal diameter in column 7. The subsequent line should only be one nominal diameter smaller than the previous one.
- After a "branch" is entered in column 2, two subsequent lines are displayed. In column 8 for the first follow-on line, now select whether the flow through the T-piece is straight or as a T-branch. The second follow-on line is always a T-branch. A diameter reduction of the follow-on line is automatically taken into account.
- Column 9 contains the extended pipe length of the line.
- The number of 90° bends is entered in column 10. However, it is also possible to enter fractions (e.g. 30° = 0.33).
- "Connections" in column 11 refers to all starting or finishing pieces on the hose, irrespective of whether they are threaded or cone connections. In the case of reducers, the connector must always be entered in the line with the smaller nominal diameter. 2 connections must be counted for a hose extension by a cone screw connection.
- The pressure losses and descriptions of components from other manufacturers can be entered in columns 12 and 13.


7
14
15
Line
Follow-on connection
Follow-on connection (line 1)
Follow-on connection (line 2)
Nominal load (kW)
Height difference (m)
Nominal diameter (DN)
T-piece
Length in (m)
90° bends (number)
Number of connections
Customer component pressure loss gas (Pa)
Comment
Pressure loss line (Pa)
Total pressure loss (Pa)
1-0 Continue 1-1 33,00 2,10 2,00 2 36 0 0
1-1 Branch 1-2 2-0 33,00 28 1,00 1,00 1 65 Meter 0 0
1-2 End 9,00 5,40 15 T branch 6,40 1,00 1 10 15E -22 -22
2-0 Branch 2-1 3-0 24,00 22 T branch 7,00 1,00 0 0
2-1 End 18,00 8,90 22 T straight 9,80 1,00 1 20 15D -36 -36
3-0 End 6,00 2,50 15 T branch 3,90 1,00 1 15 -10 -10

- Column 14 shows the pressure loss of the individual line and column 15 shows the total for the particular consumer. If the result in column 15 is larger than the permissible pressure loss then the result is shown in red. In this case, it is necessary to increase the nominal diameter in column 7 from 16 to 20 for line 2-1. Alternatively, however, changing the type and number of installed parts can produce a successful result.

Once the dialogue box has been closed (cross), the dialogue box allowing saving and printing with normal Windows functions is activated again. The entries can be edited again using the "Edit project" button.

Advantages of the software tool compared to using the table:

- The pressure loss values of the lines are only rounded off at the end of the calculation. This makes the result more accurate.
- The pipeline cross sections can be optimised very quickly. The result is displayed immediately after each entry is completed.
- Dialogue boxes that have already been created can be modified for similar projects.
- It is possible to enter the net calorific value as required, thus allowing optimum adaptation to the particular gas supply. The same applies to the operating condition of the gas.

4. ASSEMBLY HYDRA® GS PRESS

4.1. Assembly procedure

Step 1: Prepare the hose

The initial piece of the rolled-up HYDRA GS corrugated pipe must always be cut off with a clean cut prior to use. Measure the suitable pipe length.

Step 2: Cut the corrugated pipe to length

Use the corrugated pipe cutter to cut the sheathed pipe to length. The cut must be located in the groove of a corrugation. Turn the pipe cutter in one direction and slowly tighten the pressure roller after each turn.
Important: Tightening too much leads to irregular cuts and deformations. Avoid kinking and tearing the corrugated pipe after an incomplete cut.

Step 3: Expand the corrugated pipe

Now the end of the cut-to-length pipe must be expanded in order to allow the connection parts to be fitted.

To do this, the expansion head from the tool case is screwed onto standard expander tongs

The closed tool is pushed into the end of the corrugated pipe up to the collar. The expander tong is open at this stage.

Operate (close) the tong once up to the stop point. Remove the expansion head.

Step 4: Fit the connection part onto the press head; lock the pull rod with the bayonet socket

Select the appropriate press head from the tool case to match the diameter of the fitting. Push the press head from the front into the connection fitting with the threaded part foremost.

Push the press head as far as possible into the fitting.

Then insert the press head as far as possible into the axial pressing tool. Turn 90° clockwise in the chuck of the axial pressing tool to lock the press head (bayonet socket).

Briefly operate the axial pressing tool to secure the connection part on the centring piece of the axial pressing

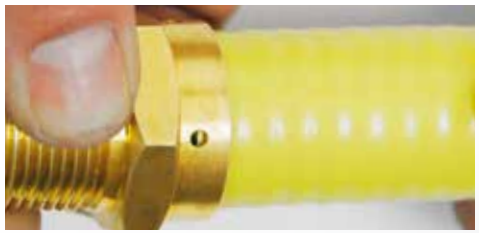
Step 5: Carry out visual inspection.

The expanded corrugated pipe is pushed over the connection part.

The necessary insertion depth has been reached when the yellow PE sheathing can be seen in the round viewing holes of the connection part.

The corrugated pipe then makes firm metal-on-metal contact with the connection part.

Right: The viewing window is completely filled by the corrugated pipe.



Wrong: Inadequate insertion depth!

The cut edge of the corrugated pipe must never be visible in the viewing window.

Step 6: Install the connection part

The battery-operated axial pressing tool is started at the push of a button

After a maximum of 8 seconds, the press head will have expanded the connection part. The axial pressing tool then switches off automatically, and it can simply be pulled out of the corrugated pipe.

Step 7: Trigger the return stroke

To remove the press head, release the slide on the rear of the tool

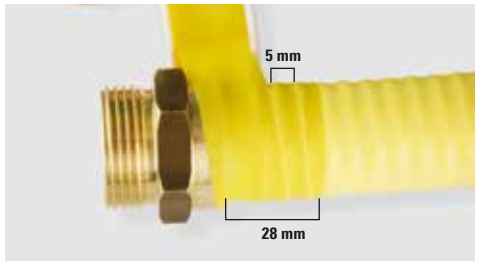
The press head then moves back to its original position

Step 8: Remove the press head

Remove the press head by pressing the unlocking mechanism on the end and by turning it 90° anticlockwise

Step 9: Seal the connection part

Wrap with adhesive tape, beginning on the hose and working towards the fitting.



Overlap the layers by approx. 0.5 cm. Make sure there are no creases.

Wrap two layers of tape around the hose and the fitting up to the nut.

5. ASSEMBLY HYDRA® GS CLICK

5.1. Assembly procedure

Step 1: Prepare the hose

The initial piece of the rolled-up HYDRA GS corrugated pipe must always be cut off with a clean cut prior to use. Measure the suitable pipe length.

Step 2: Cut the corrugated pipe to length

Use the corrugated pipe cutter to cut the sheathed pipe to length. The cut must be located in the groove of a corrugation. Turn the pipe cutter in one direction and slowly tighten the pressure roller after each turn.
Important: Tightening too much leads to irregular cuts and deformations. Avoid kinking and tearing the corrugated pipe after an incomplete cut.

Step 3: Assemble the connection part

Remove sheath from the first 6 corrugations, see sketch.

Loosen screw fitting lightly by hand.

Push the end of the hose firmly into the fitting. There will be an positive click.

Tighten the fitting using a wrench. The distance between the brass parts of the fitting (after tightening) should be 0.5 mm max.

Step 4: Seal the connection part

Wrap with adhesive tape, beginning on the hose and working towards the fitting.

Overlap the layers by approx. 0.5 cm. Make sure there are no creases.

Wrap two layers of tape around the hose and the fitting up to the nut.

6. ASSEMBLY ON PARTS OUTSIDE THE HYDRA® GS GAS INSTALLATION SYSTEM

6.1. Valid for HYDRA® GS Press and HYDRA® GS Click

External systems and fittings may only be connected together using screw fittings with standardised thread or a 24° cone.

Tightening torque for HYDRA® GS Press

Screw connections for HYDRA GS Press should be tightened with the tolerated torques as specified in the following table.

Nominal diameter of corrugated pipe DN	Tightening torque for union screw connection [Nm]
15	30 ± 10
22	30 ± 10
28	35 ± 10
32	50 ± 10

6.2. Valid for HYDRA® GS Press and HYDRA® GS Click

Minimum bending radii

When bending corrugated pipes, make sure the bending radii are not less than the minimum bending radii specified in the following table.

Nominal diameter of corrugated pipe DN	Minimum bending radius
	mm
15	25
22	30
28	45
32	60

7. GENERAL NOTES ON INSTALLATION

7.1. General instructions

- Store all HYDRA GS Press components in their original packing in a dry place.
- Make sure that the components are stored at room temperature directly before being laid.
- If the HYDRA GS stainless steel corrugated pipes were subjected to low temperatures, store them at room temperature until they themselves have room temperature.
- Before fitting, make sure that sufficient HYDRA GS system components are available for the required length and diameters.
- Install HYDRA GS stainless steel corrugated pipes in such a way that they are protected from mechanical damage.
- During fitting, avoid kinking, crimping, over-bending, over-stretching or twisting the HYDRA GS stainless steel corrugated pipe. Also avoid contact with sharp objects. Renew damaged parts.
- Avoid impairing the free flow cross-section of HYDRA GS stainless steel corrugated pipes.
- Make sure that no foreign bodies enter the corrugated pipe.
- HYDRA GS stainless steel corrugated pipes may not, under any circumstances, be used as flexible connections for apparatus (for example, instead of gas hoses).
- Prior to taking a completed installation into operation, the entire installation must be checked in accordance with the technical codes of practice.
- Fittings and components must be arranged and supported so that they cannot transmit any impermissible forces and deformations onto the pipe system.
- Corrugated pipelines do not provide a sufficiently rigid connection.
- The sealing surfaces of connection parts must remain undamaged during laying
- Connection parts must be installed where they are easily accessible
- The number of connection parts must be reduced to the minimum necessary
- Inner pipes must be laid in accordance with the applicable codes of practice.
- Charge the battery prior to initial use
- Press heads should not be greased

7.2. HYDRA® GS Fire behaviour

HYDRA GS stainless steel corrugated pipes have been tested for their fire behaviour in accordance with EN 13501-1 and have been classified as B-S 1-D2.
The PE-sheathing does not constitute an insulating layer as defined by BS 4102.

7.3. Potential equalisation

Gas pipe lines may not be used (fully or in part) as protective or operational earths or as protective earth conductors in electrical systems. Gas pipelines may not be used as a lightning conductors or earthings in lightning protection systems. The metal inner piping of each building must be connected to the relevant equipotential equalisation system. Please observe also BS 6891, 8.6 and BS 5482-1, 12.3.3.

1 Strip earthing clip on hexagon profile
2 HYDRA GS corrugated pipe
3 HYDRA GS threaded nipple

1 Strip earthing clip on hexagon profile
2 HYDRA GS corrugated pipe
3 HYDRA GS union nut nipple with adapter

7.4. Fastening and fastening distances

Gas pipelines may not be attached to other pipelines, nor may they be used as supports for other pipelines and loads. They must be arranged so that drips and condensation from other pipelines cannot have any effect on them.

Depending on the mechanical strength (tensile strength) of their pipe connections, they must be attached to components with an adequate structural strength by means of pipe brackets. The supporting parts of the pipe brackets (e.g. pipe clamps/clips, bolts) must be made from non-flammable materials. The following table provides guidance values for fastening distances of laid pipelines.

It is essential to comply with the recommended fastening distances:

Nominal diameter DN	Recommended fastening distance		
	horizontal	vertical	Bend
	m	m	m
15	1.00	2.50	0.25
22	1.25	2.50	0.30
28	1.50	2.50	0.40
32	1.75	2.50	0.45

Plastic plugs can be used if the mechanical strength of the pipeline will not be impaired in case of fire at temperatures up to 650 °C. In pipelines with pipe connections which no longer guarantee the required mechanical strength (tensile strength) when exposed to temperatures up to 650 °C, it is necessary for the plugs used to be able to withstand these temperatures (e.g. metal plugs). Furthermore, solid or comparable structural components are required in the building for the fastening points.

Only HYDRA GS BISMAT®-Flash pipe clamps and HYDRA GS Caddy holding loops certified in accordance with BS EN 15266 may be used to fasten the HYDRA GS stainless steel corrugated hose system.

The pipe clamps and holding loops are part of the overall approved system. HYDRA GS stainless steel corrugated pipes may not be installed using other pipe clamps. BISMAT Flash is a screw-in pipe clamp made from electrolytically galvanised steel with an acoustic insulation insert made from black EPDM rubber and a quick fastener. The maximum permitted load is certified acc. to RAL-GZ 655/A and is 260 N.

In order to guarantee an optimum duration of fire resistance, use plugs and threaded rods whose fire-resistance properties have been tested (dimension ≥ M8 or M10, strength class ≥ 4.6).

Insert the pipe.

Push the clamp closed by hand.

Done!

8. PROTECTION AGAINST CORROSION OR DAMAGE

Avoid any contact between the gas pipelines and acids, alkalis, salts or other corrosive substances. In addition, also avoid contact between the gas pipelines and aggressive chemical compounds which can lead to corrosion of stainless steel.

Should contact occur nevertheless, remove the chemical residues thoroughly without delay. Check the PE sheathing of the gas pipeline for damage. If the PE sheathing is undamaged, it will protect the stainless steel corrugated pipe against corrosion. If there is damage, renew the affected section.

Avoid using compounds containing chloride, e.g. for detecting leaks. Contact with such compounds can cause the HYDRA GS stainless steel corrugated pipes to corrode.

9. RECOMMENDATIONS FOR STORING THE GASKETS

At all intermediate stages between manufacture and use, store the gaskets in accordance with the recommendations of ISO 22301.

Comply with the following points:

a) The storage temperature should be below 25 °C, preferably below 15 °C.
b) The gaskets should be protected against light, in particular against strong sunlight and artificial light with a high ultraviolet proportion.
c) The gaskets should not be stored in a room containing systems that can generate ozone, e.g. mercury arc lamps or devices with high-voltage electricity which can cause sparking and dark electrical discharges.
d) The gaskets should be stored without stress, i.e. without tension, pressure or other deformations; for example, they should not be hung up.
e) The gaskets should be kept clean.

10. REPAIR METHODS

10.1. Damage to the HYDRA® GS stainless steel corrugated pipes

The flexible corrugated pipes must be renewed without fail if:

- there is visible damage to the PE sheathing.
- the corrugated pipe has been bent too tightly, leaving a kink.
- the corrugated pipe has been damaged by a sharp or pointed object.
- the corrugated pipe has been significantly compressed.
- there is a pressure loss in the hose assembly

Renewal of the entire corrugated pipe length is recommended for safety reasons, in order to avoid having screw connections in cavities. In addition, in most cases this procedure is more economical than repairing only part of a section.
If a section is to be repaired, it is possible, depending on the length of the pipeline remaining, to remove the damaged part and connect the parts left using HYDRA GS screw connections. If the remaining lengths are short, it is possible to use a pipeline section with two HYDRA GS screw connections between the two remaining sections.
Note: A leak test must always be carried out after each repair.